instrumental variables (IV) approach was used. The essence of the IV approach is to find variables which can help to predict the variable which is suspected of measurement error. Although the exact revenues for these other media outlets are unknown, the *number* of each type for each of our three geographic markets is known. These counts are clearly correlated with the HHIs, and thus are a natural choice to serve as instruments. For example, the total number of radio stations, TV stations, and newspapers in the DMA were used in a "first-stage" regression to predict the value of the HHI when the HHI is calculated for a candidate geographic market defined as the DMA and product market defined to include all three media (the lower left corner of Figure 1). There were no qualitative differences in the results between the standard OLS and IV approaches. The results presented below and in the Appendix are based on the IV approach.

Within a given market area, the identity of the firms included in the HHI calculation could change according to the product or geographic market being considered. Obviously, radio, TV and newspaper revenues were included or excluded according to whether the HHI was for a candidate product market that included or excluded those media. With respect to geographic market, the following procedures were used:

- DMA: All TV stations, radio stations, and newspapers located or published in the DMA were included.

- Arbitron Metro Market: All radio stations in the Metro Market, all TV stations located in the DMA that includes the Metro Market, and all newspapers published in the Metro Market were included.

- Newspaper Community: All TV stations with a Grade A contour that encompasses the newspaper community were included. All radio stations with a 1 mV/m (for FM stations) and 2 mV/m (for AM stations) contour that encompasses the community were included. All newspapers located in the newspaper community were included. The community is defined by its constituent zip codes.

The weight placed on the revenues of each market participant when calculating the HHI also differs across alternative geographic market definitions. Where appropriate, total 1995 revenues of a newspaper or a TV or radio station were reduced to approximate the portion of their total audience that lay inside each geographic market being considered. This adjustment was made to reflect the relative significance of each firm in reaching the audience in the geographic market under consideration. Total audience was defined to be the DMA for TV stations, the Arbitron Metro Market for radio stations, and the City Zone (CZ) or Newspaper Designated Market (NDM) for newspapers.[7] The following specific revenue adjustments were made in the geographic markets indicated:

- DMA: Total TV and radio station revenue and newspaper revenue were used without adjustment.

- Arbitron Metro Market: TV station revenue was multiplied by the ratio (households located in the Arbitron Metro Market / households located in the DMA). Radio station revenue and newspaper revenue were used without adjustment.

- Newspaper Community: TV station revenue was multiplied by the ratio (households located in the newspaper community / households located in the DMA). Radio station revenue was multiplied by the ratio (households located in the newspaper community / households located in the Arbitron Metro Market). Newspaper revenue was multiplied by the ratio (circulation in the newspaper community / CZ or NDM circulation).

Other explanatory variables used in the regression analysis were drawn from the BIA radio and TV databases. Individual variables are explained below.

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[7]   Circulation for these areas, which are believed to include core geographic areas of interest to advertisers, is reported in *SRDS Circulation 97*.

Findings

In each analysis, a regression model was first formulated using the available independent variables that provided the best explanatory fit. Separate regressions were then run adding to the basic model each of the HHI variables under examination.

To explain variations in the prices of radio station sales, a basic model was formulated expressing the sale price of a radio station (measured in constant 1996 dollars) as a function of the following explanatory variables:

Variable	Definition
EBI	Effective Buying Income in the market
RATE	Fall 1994 all-dayparts station ratings
REVGROW	Percentage growth in station revenues, 1994-95
FM	Equals 1 if the station is FM, 0 if AM
NETWORK	Equals 1 if the station is network affiliated, 0 otherwise

If the properly defined product market includes only radio and newspaper, or only radio, newspaper and TV, then an HHI that includes these media should appear as a significant variable in a regression equation. This was tested using each of the alternative geographic markets explained above. The results are summarized in Table 1. Each regression equation explained a large proportion of the variation in radio station sales prices, with R^2 values ranging from 0.444 to 0.508. These are strong results, especially in light of the small number of observations (38). In addition, the signs and magnitudes of the coefficients on each of the independent variables are plausible (see Appendix for the full results). However, in none of these regressions was the HHI variable significant. The highest t-statistic estimated was 1.1, well short of the value of 1.69 required for statistical significance.[8]

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[8]   Based on a one-tailed test at 95 percent significance level.

Table 1: HHIs' Significance in Explaining Radio Station Sale Prices

		DMA	Arbitron	Community
Radio-Newspaper	R^2	.508	.489	.444
	t-statistic	-.041	.366	1.101
Radio-Newspaper-TV	R^2	.506	.506	.506
	t-statistic	-.080	.303	.743

A separate analysis was performed using a sample of TV station sale prices. The basic model was formulated using the following variables:

Variable	Definition
RETGROW	Percentage growth in retail sales, 1994-95
VHF	Equals 1 if the station is VHF, 0 if UHF
EBI	Effective Buying Income in the market
CABLE	Percentage of households receiving cable TV as a percentage of all households
HISPANIC	Hispanic households as a percentage of all households

Table 2 shows the results obtained when each candidate HHI was added to this basic model. Overall, the fit of the model was excellent, with all R^2s greater than 0.5. In addition, the estimated coefficients on the explanatory variables were plausible (see Appendix for full results). Neither HHIs calculated for a TV-newspaper candidate market nor HHIs calculated for a TV-newspaper-radio candidate market had any significant explanatory power. Values for t-statistics ranged from negative to approximately 1.2.

Table 2: HHIs' Significance in Explaining TV Station Sale Prices

		DMA	Arbitron	Community
TV-Newspaper	R^2	.504	.506	.517
	t-statistic	-.321	.352	.202
TV-Newspaper-Radio	R^2	.515	.518	.515
	t-statistic	-.454	-.457	1.234

A separate, parallel analysis was attempted using radio and TV advertising prices, rather than station sale prices, as the indicator of competitiveness in individual markets. The dependent variable in these regressions was the cost per thousand (CPM) in the fourth quarter of 1995.[9] Like the HHI measures of concentration, these CPMs were derived separately for each geographic market. They were constructed by adjusting estimated cost per point (CPP) figures for the market as a whole by the size of the audience in each geographic market. Thus three separate equations, one for each geographic market, were estimated for both radio and television.

The overall results from these regressions were inconclusive for both radio and television. It was not possible to develop a consistent base model for all three geographic markets. Moreover, it was difficult to develop a reasonable base model even within a particular geographic market. The estimated coefficients on variables which should in theory help predict advertising prices were in many cases found not to be statistically significant. In other cases, the estimated coefficients had implausible signs and/or magnitudes.

Several factors may help explain why the station sale price regression analysis performed well while the advertising price regression analysis did not. First, station sale prices should capture long-run profit streams that can be explained by observable station and market characteristics. By contrast, advertising prices in a single quarter are subject to many temporary

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[9]   Normally defined as the cost per thousand *households* for television, or the cost per thousand *listeners* for radio.

influences that were not accurately captured by the available explanatory variables. Second, the price data themselves are estimated, rather than actual, spot rates in individual dayparts based on interviews with advertisers in each local market. As estimates, they are subject to greater measurement error than station sales prices. Third, we are using proxies for the correct denominators when deriving the CPMs. For example, the figure needed to construct the CPM for the community market is the number of radio listeners in that market. We have only the number of households for the community market, which is then scaled up by a national persons-per-household figure rather than a market-specific figure.

Conclusion

Loosening restrictions on the joint ownership of radio stations and newspapers, as the Commission is considering, could have an effect on competition in the sale of advertising within local markets. The effect of any individual proposed joint ownership is best analyzed in the context of the conditions prevailing in that local market. That analysis should include a determination of the proper relevant product market and relevant geographic market. If radio stations and newspapers do not compete for advertising, there can be no competitive effect from joint ownership. This paper provides evidence that a market consisting of radio and newspaper, or of radio, newspaper and TV, does not include all the relevant competing media. In its fact-specific investigations of local markets, the Commission should begin with the presumption that these media compete significantly with direct mail, outdoor, and other advertising as well.

Appendix

Sources

The following basic information sources were used:

BIA MasterAccess Radio Analyzer, Version 1.7, November 1996; Version 1.5, November 1995 (BIA Publications). Source for radio station sales prices and terms, ownership, 1995 revenue, DMA market, Arbitron Metro Market,

community and number of radio stations in each market area as well as each of the regressors listed in Table A-1.

BIA Map Viewer, Version 1.5, 1996 Edition (BIA Publications). Source for estimated 1 mV/m (for FM stations) and 2 mV/m (for AM stations) contours.

BIA MasterAccess Television Analyzer, September 1996 (BIA Publications). Source for TV sales prices and terms, ownership, 1995 revenue, DMA market, community, number of television stations in each market area as well as each of the regressors listed in Table A-2.

Duncan's Radio Market Guide, 1996 Edition (Duncan's American Radio, Inc.). Source for revenues for selected newspapers.

SRDS Circulation 97 (SRDS). Source for newspaper circulation in City Zone or Newspaper Designated Market, number of households in DMA and counties in Arbitron markets and number of daily newspapers in each market area.

Editor & Publisher International Yearbook, 1994 (Editor & Publisher). Source for ownership and location of newspapers.

Access ABC: Newspapers, November 1994 to August 1996 (Audit Bureau of Circulation). Source for newspaper circulation in zip codes located within selected communities. This was supplemented with information from selected individual newspapers.

1996 Commercial Atlas & Marketing Guide, 127th Edition (Rand-McNally). Source for zip codes within selected communities.

Broadcast & Cable Yearbook 1996, Volume 1 (R.R. Bowker). Source for identification of public television stations (excluded from analysis).

Arbitron Radio Metro Market Guide, 1995-1996 (The Arbitron Co.). Source for identification of counties in DMA and Arbitron metro markets.

Television & Cable Factbook: TV Stations, 1996 (Warren Publishing, Inc.). Source for estimated Grade A contour lines and TV station ownership.

Market Media Guide, 1995 (Media Market Resources, Inc.). Source for estimated spot prices of radio and TV, by daypart, by Arbitron market or DMA.

Table A-1: Variables used in radio station sale and radio advertising price regressions

CLASS	Class of Facility - FM: A, B, B1, B2, C, C1, C2, C3; AM: I, II, III, IV.
FORMAT	Station's format.
FM	Equals 1 if the station is FM, 0 if AM.
GROUP	Code for whether the station owner also owns other stations.
HAAT	Height Above Average Terrain (antenna height in ft.).
RANK	Arbitron Market Rank.
NUMSTAS	Number of other stations owned by owner of this station.
DAYPOWER	Station power in watts. Daytime-only power for AM, full-time power for FM.
LOCAL	Percentage of total market revenues derived from local advertising.
NATIONAL	Percentage of total market revenues derived from national advertising.
ASIAN	Percentage of market population which is Asian.
BLACK	Percentage of market population which is Black.
WHITE	Percentage of market population which is White.
HHINC	Average household income ($).
CABLE	Percentage of households receiving cable TV as a percentage of all households.
EBI	Effective Buying Income (per capita, $).
EBIGROW	Percentage growth in Effective Buying Income, 1994-5.
PRET	Retail sales in the market, per capita.
RETGROW	Percentage growth in retail sales in the market, 1994-5.
MEDIAN	Median income in the market ($).
NETWORK	Indicates whether station is network-affiliated.
REVGROW	Percentage growth in station revenues, 1994-95.
RATE	Fall 1994 all-dayparts station ratings.
RPRICE	The sale price of the station, in 1996 dollars ($000; dependent variable)
DHH	Number of households in the DMA market (000s).
AHH	Number of households in the Arbitron Metro Market (000s).
CHH	Number of households in the community market (000s).
CPMD	Cost per 1000 listeners in the DMA market ($).

| CPMA | Cost per 1000 listeners in the Arbitron Metro Market ($). |
| CPMC | Cost per 1000 listeners in the community market ($). |

Table A-2: Variables used in TV station sale and TV advertising price regressions

TYPE	Type of facility - primary, satellite, public, low power.
ANTENNA	Indicates whether antenna polarization is horizontal, circular, or elliptical.
VHF	Equals 1 if the station is VHF, 0 if UHF.
GROUP	Code for whether the station owner also owns other stations.
HAAT	Height Above Average Terrain (antenna height in ft.).
RANK	DMA Market Rank.
NUMSTAS	Number of other stations owned by owner of this station.
POWER	Transmitter power in kilowatts.
LOCAL	Percentage of total market revenues derived from local advertising.
NATIONAL	Percentage of total market revenues derived from national advertising.
ASIAN	Percentage of market population which is Asian.
BLACK	Percentage of market population which is Black.
WHITE	Percentage of market population which is White.
HHINC	Average household income ($).
CABLE	Percentage of households receiving cable TV as a percentage of all households.
VCR	Percentage of households owning VCRs.
EBI	Effective Buying Income (per capita, $).
EBIGROW	Percentage growth in Effective Buying Income, 1994-5.
PRET	Retail sales in the market, per capita.
RETGROW	Percentage growth in retail sales in the market, 1994-5.
MEDIAN	Median income in the market ($).
NETWORK	Indicates whether station is network-affiliated.
REVGROW	Percentage growth in station revenues, 1994-95.
RATE	Fall 1994 all-dayparts station ratings.
RPRICE	The sale price of the station, in 1996 dollars ($000; dependent variable)
DHH	Number of households in the DMA market (000s).
AHH	Number of households in the Arbitron Metro Market (000s).
CHH	Number of households in the community market (000s).
CPMD	Cost per 1000 households in the DMA market ($).
CPMA	Cost per 1000 households in the Arbitron Metro Market ($).
CPMC	Cost per 1000 households in the community market ($).

Regression Results - Radio Station Sales

DMA market

Newspaper, Radio included

(2SLS)
F-statistic for regression F(6,31) =   5.32
R-square   = 0.5078

rprice	Coef.	Std. Err.	T-statistic
HHI	-0.08848	2.184616	-0.041
fm	5490.645	3063.219	1.792
ebi	0.126504	0.058821	2.151
network	8935.907	3088.318	2.893
rate	1326.141	724.1657	1.831
revgrow	1109.616	622.6602	1.782
constant	-11328.9	10393.38	-1.090

Newspaper, Radio, and TV included

(2SLS)
F-statistic for regression F(6,31) =   5.30
R-square   = 0.5059

rprice	Coef.	Std. Err.	T-statistic
HHI	-0.41412	5.200739	-0.080
fm	5473.089	3071.435	1.782
ebi	0.126386	0.049574	2.549
network	8924.132	3020.911	2.954
rate	1330.816	725.4066	1.835
revgrow	1103.013	623.8472	1.768
constant	-10900.3	10952.81	-0.995

Regression Results - Radio Station Sales

Arbitron market

Newspaper, Radio included

(2SLS)
F-statistic for regression $F(6,31) = 5.15$
R-square   = 0.4889

rprice	Coef.	Std. Err.	T-statistic
HHI	0.834018	2.281793	0.366
fm	5731.536	3152.738	1.818
ebi	0.142725	0.060885	2.344
network	9222.664	3086.411	2.988
rate	1347.153	738.6321	1.824
revgrow	1043.231	655.9085	1.591
constant	-15543.1	11076.31	-1.40

Newspaper, Radio, and TV included

(2SLS)
F-statistic for regression $F(6,31) = 5.31$
R-square   = 0.5056

rprice	Coef.	Std. Err.	T-statistic
HHI	1.817174	6.000181	0.303
fm	5818.707	3210.601	1.812
ebi	0.139682	0.059179	2.360
network	9023.713	2964.875	3.044
rate	1333.543	724.8618	1.840
revgrow	1083.723	626.4851	1.730
constant	-15940.54	14384.50	-1.108

Regression Results - Radio Station Sales

Community market

Newspaper, Radio included

(2SLS)
F-statistic for regression F(6,31) =   4.91
R-square   = 0.4441

rprice	Coef.	Std. Err.	T-statistic
HHI	2.909518	2.641904	1.101
fm	6239.649	3293.267	1.895
ebi	0.119429	0.048358	2.470
network	7899.388	3286.636	2.403
rate	1450.127	776.3776	1.868
revgrow	1227.515	668.1173	1.837
constant	-27803.11	15094.58	-1.842

Newspaper, Radio, and TV included

(2SLS)
F-statistic for regression F(6,31) =   5.39
R-square   = 0.5058

rprice	Coef.	Std. Err.	T-statistic
HHI	2.960664	3.986046	0.743
fm	5774.145	3062.229	1.886
ebi	0.102204	0.056874	1.797
network	7934.915	3272.586	2.425
rate	1441.016	740.3326	1.946
revgrow	1371.185	715.8092	1.916
constant	-20685.9	12595.03	-1.642

Regression Results - TV Station Sales

DMA market

Newspaper, TV included

(2SLS)
F-statistic for regression F(6,24) = 4.17
R-square   = 0.5040

rprice	Coef.	Std. Err.	T-statistic
HHI	-7.71573	24.01584	-0.321
vhf	73720.76	19162.4	3.847
cable	2660.591	1380.442	1.927
ebi	0.401475	0.2243801	1.789
hispanic	-1164.78	631.0987	-1.846
retgrow	9206.415	5389.598	1.708
constant	-1917940	128352.4	-1.494

Newspaper, TV, and Radio included

(2SLS)
F-statistic for regression F(6,24) = 4.29
R-square   = 0.5154

rprice	Coef.	Std. Err.	T-statistic
HHI	-9.39752	20.69767	-0.454
vhf	73229.73	18871.13	3.881
cable	2686.585	1360.365	1.975
ebi	0.410205	0.196847	2.084
hispanic	-1183.927	621.8446	-1.904
retgrow	9173.663	5146.250	1.783
constant	-196423	115699.1	-1.698

Regression Results - TV Station Sales

Arbitron market

Newspaper, TV included

(2SLS)
F-statistic for regression F(6,24) =   4.19
R-square   = 0.5055

rprice	Coef.	Std. Err.	T-statistic
HHI	6.818136	19.37838	0.352
vhf	73217.76	19063.13	3.841
cable	2889.768	1481.074	1.951
ebi	0.493390	.2374533	2.078
hispanic	-1057.22	719.7481	-1.469
retgrow	7907.772	5407.543	1.462
constant	-247894.6	151003.2	-1.642

Newspaper, TV, and Radio included

(2SLS)
F-statistic for regression F(6,24) =   4.31
R-square   = 0.5177

rprice	Coef.	Std. Err.	T-statistic
HHI	-7.74004	16.92736	-0.457
vhf	72699.96	18857.83	3.855
cable	2579.006	1380.655	1.868
ebi	0.407243	0.198626	2.050
hispanic	-1272.10	651.6483	-1.952
retgrow	9130.955	5110.599	1.787
constant	-186931.6	123148.3	-1.518

Regression Results - TV Station Sales

Community market

Newspaper, TV included

(2SLS)
F-statistic for regression $F(6,24) = $ 4.27
R-square = 0.5167

rprice	Coef.	Std. Err.	T-statistic
HHI	4.63348	22.98211	0.202
vhf	75102.7	21086.37	3.562
cable	2738.763	1375.487	1.991
ebi	0.473928	0.244298	1.940
hispanic	-1035.36	952.0641	-1.087
retgrow	8493.014	5008.864	1.696
constant	-239830.7	176348.4	-1.360

Newspaper, TV, and Radio included

(2SLS)
F-statistic for regression $F(6,24) = $ 1.97
R-square = 0.515

rprice	Coef.	Std. Err.	T-statistic
HHI	54.68336	44.33169	1.234
vhf	94778.47	34449.02	2.751
cable	2965.758	2150.186	1.379
ebi	0.864409	0.448942	1.925
hispanic	-43.6964	1343.870	-0.033
retgrow	12635.26	8498.858	1.487
constant	-464774.4	268555.7	-1.731

Table A-3: Means for variables used in station sale price analyses

Radio

Variable	Mean
EBI	32856.7
RATE	1.905
REVGROW	4.371
NETWORK	0.184^{10}
FM	0.605^{10}

Television

Variable	Mean
EBI	58285.6
RETGROW	4.932
CABLE	67.677
HISPANIC	8.574
VHF	0.290^{11}

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[10]   FM and NETWORK are dummy variables. Of the radio stations used in this analysis, 23 of 38 were FM. 7 radio stations were network affiliated.

[11]   VHF is a dummy variable. Of the television stations used in this analysis, 9 of 31 were VHF.